CMPE 124 Lab 1: Signal Generators Tests AND, OR, XOR

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***Abstract*—The purpose of this lab project is to introduce us to LogicWorks and the concept of clocks and logic functions.**

I. Introduction

This lab project is based on the implementation of a clock-counter circuit, a logical circuit that tracks time by using bits.

II. Design Methodology

For this lab project, we use the 74LS163 4-bit counter. This 4-bits counter requires not only a voltage source—to function—and a clock—to provide it with time input—but also a binary switch, to reset it and ensure the wave functions it outputs are correct. Finally, although we use a resistor, its value can be changed or ignored; our 1kΩ resistor is part of the circuit to demonstrate that we are not focusing on the input voltage, but on the H and L states instead.

A. Parts List

- Clock
- 5V Source
- 74LS163
- Binary switch
- Resistor

B. Truth Tables

State	0	1	2	3	4	5	6	7	8	9	A	B	C	D	E	F
q_0	0	1	0	1	0	1	0	1	0	1	0	1	0	1	0	1
q_1	0	0	1	1	0	0	1	1	0	0	1	1	0	0	1	1
q_2	0	0	0	0	1	1	1	1	0	0	0	0	1	1	1	1
q_3	0	0	0	0	0	0	0	0	1	1	1	1	1	1	1	1

Figure 1. Truth table for a 74LS163 4-bit counter.

C. Schematics

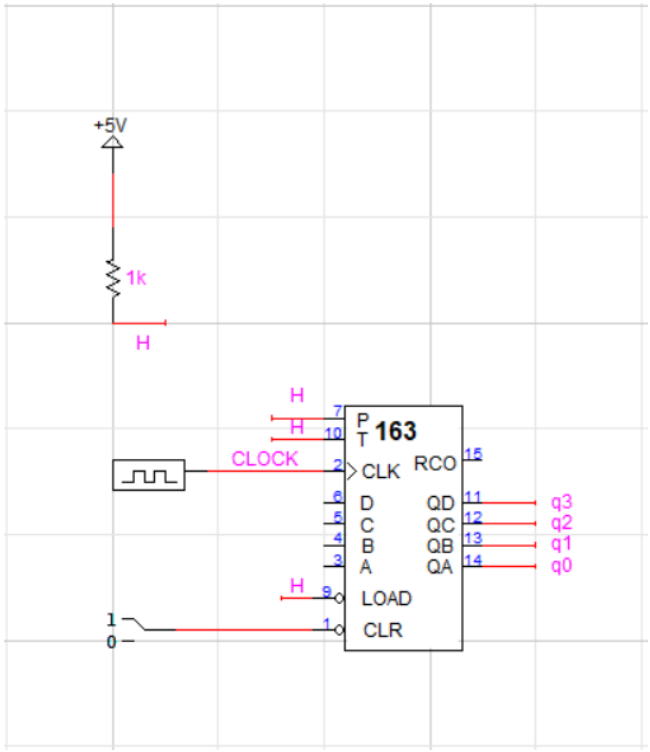

Figure 2. 74LS163 clock-counter circuit scheme.

III. Testing Procedures

The testing procedure should be broken down into steps:

1. Create clock-counter circuit as pictured in Figure 2.
2. Reset the CLR with a switch.
3. Run the clock and collect the waveform outputs for the clock, q0, q1, q2, and q3.

IV. TESTING RESULTS

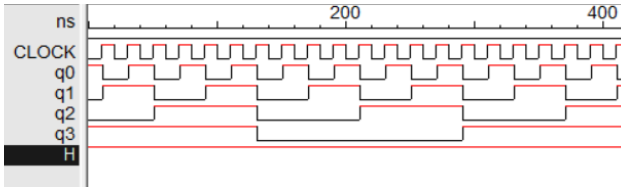

Figure 3. 74LS163 clock-counter circuit simulation.

V. CONCLUSION

In conclusion, a 4-bits binary number can be represented by a 74LS163 clock-counter circuit. The q0 output represents the lowest bit, changing and keeping that state as soon as the clock wave function changes, and q1 does the same with q0, as well as q2 with q1, and q3 with q2. The q0, q1, q2, and q3 wave functions encode for a 4-bit binary number that depends on the circuit's clock, hence we call our circuit a 4-bit clock-counter.